TEXTILE RESEARCH

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CONTENTS

The Editor's Page 306

Revised Program of Drying Research 307

Textile Fibres in the Light of Modern Science. E. R. Schwarz. *A Textile Foundation Publication* 310

Needle Type Thickness Gauge. J. N. Dow 327

Abstracts 330

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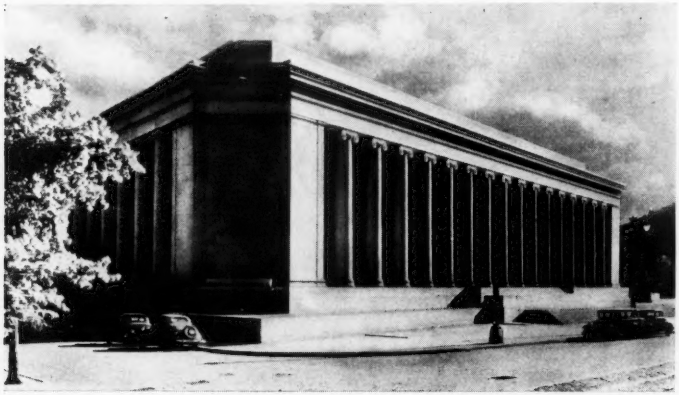
The Editor's Page

THE wonderful new building of the Mellon Institute of Industrial Research, Pittsburgh, Pa., which was dedicated May 6, has been termed a "temple of science," a "monument to science," etc. Admitting that it is a fitting building in which to wonder at the accomplishments of science, and a fitting monument to the industrial research procedure conceived by Robert Kennedy Duncan and made possible by the founders, Andrew W. and Richard B. Mellon, it is essentially the most beautiful and most advanced scientific workshop that modern knowledge could provide. Not until new findings of science within or outside of its walls render its facilities for research obsolete will it become a mere temple or monument. Let us hope that by that time, if not before, the textile industry will have been sufficiently "sold" on the value of scientific research to be seeking a suitable central laboratory of its own.



The New Home of Mellon Institute of Industrial Research, University of Pittsburgh. Dedicated, May 6, 1937.

* * *

THE third conference at Dearborn, Mich., last week of representatives of agriculture, industry and science under the sponsorship of the Farm Chemurgic Council and The Chemical Foundation, Inc., presented conclusive evidence of what may be accomplished by intelligent co-operation of allied interests to advance the industrial use of American farm products through applied science. A few of the new things developed thus far by this co-operative effort are kraft and newsprint papers from southern slash pine, starch from sweet potatoes, paper from seed flax fibre and hemp, the motor fuel "agrol" from farm crops, and new farm crop sources of plastics and vegetable oils. Not only because Hon. Francis P. Garvan is president of

U. S. Institute for Textile Research as well as of The Chemical Foundation and the Farm Chemurgic Council, should members of the former be actively interested in this great work, but because it is a practical demonstration of the value of scientific research.

* * *

IT was no fault of the Textile Division of the American Society of Mechanical Engineers and the textile organizations associated with it in sponsoring the rayon technical conference in Washington, D. C., May 14 and 15, that as a celebration of the 25th anniversary of the manufacture of rayon in this country it was an anti-climax. So completely had the subject been covered previously in the Trade Press, and at association meetings that the sponsors of this conference are to be complimented in having sought and found many allied subjects worthy of presentation. Among them was the paper by Albert Palmer on Synthetic Fibre Weaving, that of Dr. F. Bonnet on Manufacture of Cut Rayon Staple, of Ephraim Freedman on The History of Rayon in the Retail Field, and the papers by James McGibbon and John Macia on rayon crêpe manufacture.

* * *

THE freedom with which scientists and research workers discuss and make public their basic findings, and the liberality with which industrial, as well as institutional and governmental research organizations make available for public use the valuable new instruments and techniques that they have developed, are causes of wonderment by the industrial executive who jealously guards his "trade secrets." An example is the ingenious fabric thickness gauge described and illustrated in this issue, which was developed and is thus made available for public use by the technical department of Bigelow-Sanford Carpet Co., of which G. E. Hopkins is director. It is true that basic scientific principles are seldom of patentable value in their unapplied state, and it is also true that many research instruments and techniques have little merchandising value. But this is equally true of a large proportion of the so-called "trade secrets"; they are either matters of general knowledge or are obsolete in efficient plants. Somewhat analogous to the liberal attitude of scientists and research men is that of manufacturers who throw their plants wide open to competitors who will return the courtesy, on the principle that it is their fault if they do not get more out of the opportunity than does the other fellow.

Revised Program of Drying Research

THE Administration Committee for the research on the drying of textiles, which is to be conducted by U. S. Institute for Textile Research at the National Bureau of Standards under the latter's research associate plan, announces the appointment as research associate of James G. Wiegerink. He has been working for his doctor's degree at Ohio State University, and was selected by the committee as exceptionally well fitted for the work after consideration of a number of other applicants.

The Administration Committee (G. E. Hopkins, Chm., Dr. A. C. Walker and Dr. F. Bonnet) has submitted to co-operators in the drying project the following revised program after giving due consideration to recommendations of the sponsors at the conference in Washington, D. C., April 15:

Purposes of Project

"We propose to study the mechanism of adsorption and desorption of moisture by the common textile fibres, and to determine such data as will be required in setting up ideal drying conditions for the maximum protection to the fibre.

"An associate well grounded in the fundamentals of physics and chemistry, and preferably with some engineering background, will be given appropriate facilities at the Bureau of Standards as arranged between the Research Council and the Director of the Bureau of Standards.

"A complete survey will be made of the literature on the drying of textile fibres from which the available data will be tabulated, together with comments as to reliability and the value of such data. The investigation will be directed towards checking the obvious inconsistencies, and filling in the gaps in such a tabulation.

The Research Program

"The preliminary program of study will include the items listed below. These will be carried on in a sequence which will allow for the most efficient utilization of the laboratory equipment, and at the same time provide reasonably prompt development of data most needed by the industry.

"1. Textile fibres of known history, which have not been previously processed, will be freed of foreign matter, and checked as to physical condition and chemical purity. Appropriate laboratory procedures will be developed to determine the amount of regain associated with each fibre in equilibrium with atmospheric conditions over the complete range of relative humidity, and with temperatures ranging from 15° C. to charring temperatures.

"2. The chemical composition and the physical characteristics of each fibre under a complete range of regain conditions will be determined.

"3. The influence of previous exposures, such as previous drying, speed of removal of moisture, speed of acquisition of moisture, sudden temperature changes and the contact with hot surfaces, will be studied as they effect the chemical and physical characteristics of the fibre as determined at various regains.

"4. The effect of those materials commonly associated with textile fibres, such as starch, gelatin, dyestuffs, finishing materials and preservatives, will be studied to determine their influence on the chemical and physical characteristics of the fibre at various regains.

"5. The influence of the hydrogen ion concentration of the impurities listed above will be studied to determine its influence on the physical and chemical characteristics of the fibre at various regains.

"It is assumed that sections of this program may be deleted and supplementary work added as may be indicated in the progress of the research."

Rule-of-Thumb Era is Passing

"HAMPERED by lack of whole-hearted moral and liberal financial support by the industry in general, the comparatively small groups of research-minded textile men continue undaunted in their efforts to popularize textile research in this country. Some of the projects initiated by the American Association of Textile Chemists and Colorists, the United

States Institute for Textile Research, and the Throwsters Research Institute are well under way, and during the last year have yielded valuable information, previously unknown, on such subjects as the effect of alkalies on wool, properties of vat printing pastes, rayon warp sizing, mercerizing of cotton and creping of rayon fabrics. Funds are now being solicited to make possible an investigation of textile drying—one of the most important, but least understood of textile operations. Within the next few years, the research organizations should be able to offer tangible proof of their thesis that research pays dividends. When that time comes, textile-mill owners no longer will have to be begged to finance co-operative research. Instead, in the good old American way, everybody will jump on the band wagon and money will be supplied in plenty to make this country the leader in textile research. The era of rule-of-thumb methods is passing. Slowly, but inevitably, an era of progress based on fundamental knowledge is dawning.'' *Textile World*, Feb. 28, 1937, P. 163.

Science and Empiricism

American industry maintains 35,000 workers in 1,000 industrial laboratories spending $17,875,000 per month on research, according to data compiled by the National Association of Manufacturers.

* * *

A new flame-proofing agent for textiles and paper is on display by E. I. du Pont de Nemours & Co., in their exhibit at the Museum of Science and Industry, R. C. A. Building, New York City.

* * *

Pearly and iridescent effects on textiles are produced by an Austrian invention, according to *Science News Letter*, by applying to the material a lather of solutions of cellulose or cellulose derivatives ''in such a way that the lather solidifies.''

* * *

Synthetic wool having a protein base extracted from soya beans is envisioned by Dr. Harry E. Barnard, research director of the Farm Chemurgic Council. The soya bean protein is similar to the casein of milk which is the base of ''Lanital,'' the Italian artificial wool.

* * *

Fabrics more opaque to ultra-violet rays than most close-woven textile materials would seem to be of limited utility, yet, according to the *Textile Colorist*, Japanese Patent No. 111,539 (1935) covers such a fabric. A fabric for bathing suits permitting controlled transmission of ultra-violet rays should be more salable, particularly where prudish regulation of beach dress still persists.

* * *

Air-conditioned fabrics are a logical sequence of air-conditioned homes, factories and office buildings. This means fabrics of smooth, lintless yarns, preferably impregnated with a suitable synthetic resin to resist abrasion. Combed, gassed and mercerized cotton yarns are the basis of very satisfactory air-permeable fabrics. Fortunately, or unfortunately, there is little exact scientific knowledge regarding the hygienic properties of clothing.

(*Continued on P. 329.*)

Textile Fibres in the Light of Modern Science*

By EDWARD R. SCHWARZ, F. T. I.†

A Textile Foundation Publication

(*Continued from Vol. VII, No. 7*)

TRULY nature has developed textile materials over vast periods of time by means of evolution. Man's empirical method consists of synthesis, followed by analysis—repeated many times. He first must build an experimental structure only to find it imperfect and tear it down again, rebuild—and so on and on.

The method which is being followed in the work supported by the Textile Foundation has been more nearly the reverse. It consists of analysis, later to be followed by synthesis based on the knowledge obtained. This method can be used easily in textiles since we have the finished fibres with which to work, provided by nature. Research is after all only an attempt to learn the secrets of nature. Such fibres must be analyzed to the last atom both chemically and physically before an intelligent synthesis is possible. The results of the work which are to be summarized and discussed in the following pages must therefore be understood to be the partial results of analysis, and the development of analytical technique. They are not results which are so valuable in themselves as they are important for what they may make possible.

J. Arthur Thompson has said, "The practical utility of the sciences is so great that there is danger of exaggerating utilitarian criteria. Nothing is more certain than the fundamental value of 'theoretical science.' But while the greatest practical gains have come from the prosecution of 'pure science' it may be agreed that Science should be socialized, for, after all, Science is for Life, not Life for Science: The first step in scientific pro-

* An "inside story" in simple terms of the physicist's attack on the problems of fibre structure.

† Associate Professor of Textile Engineering, in charge of Textile Research, Mass. Institute of Technology, Cambridge, Mass.

cedure is to collect data, and all science begins with measurement. The second step is the arrangement and classification of facts. Auxiliary to this and to formulation is the process of analysis or reduction to simpler terms."

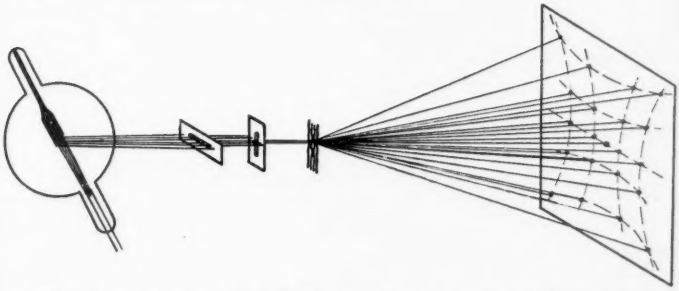


FIG. 22. Diagram showing how an X-ray beam is diffracted by a bundle of fibres and registers on a photographic emulsion. From the photograph, knowing the dimensions involved in the set-up of apparatus, the separation of structural units of the fibres can be computed.

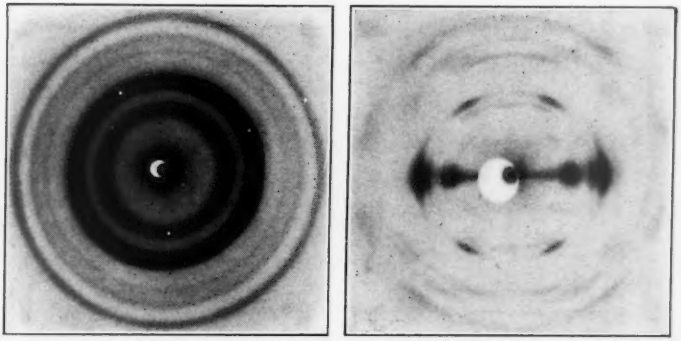


FIG. 23. The characteristic pattern for cellulose (as obtained from a random mass of cotton linters) is a series of definitely spaced concentric rings. The pattern on the right was obtained from a bundle of parallel ramie fibres and shows the effect of orientation (lining-up) of the molecular structure.

Even the Blind Shall See

The scientist is trying to study things which he cannot hope to see directly. No layman's understanding of the task can be possible until he appreciates something of the difficulties involved. The scientist is in something of the position of a blind

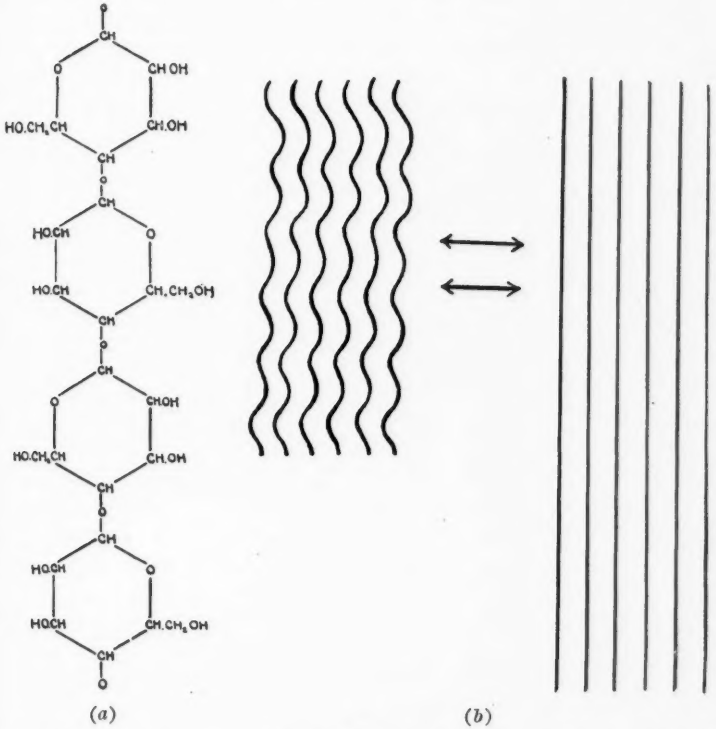
mathematician in a field and confronted with a building of unknown shape and size. This blind man has behind him a row of metal tubes closely spaced and suspended vertically. Each differs in length from its neighbor. Each, when struck, gives out a different musical sound. The blind man paces off the distance from the row of tubes to the building and to his position. He induces someone with faith in him to provide him with a plentiful supply of small rubber balls, and a powerful oversize air rifle. He stands facing the building and shoots repeatedly at it. Each ball bounces from some portion of the structure; now from a wall, now from a porch, now from the roof, now from an ell, and upon its return ends by striking a tube. By the note given forth the blind man can tell the location of the tube in the row. He knows where the ball started, when it struck and where it landed. By difficult and tedious calculations he can gain some idea of the shape and size of the building at which he was shooting. "A silly way to do," you say. Yet in the x-ray investigation of fibre structure much the same technique must be employed. It is very much like looking for a black cat in a coal bin in a dark cellar.

If for the air rifle we substitute an x-ray tube, for the rubber balls an emitted stream of electrons, for the house a bundle of fibre, and for the row of tubes a photographic emulsion supported on a film or plate, we have a close parallel. By noting the distances from the tube to the fibre bundle and to the emulsion, respectively, and by carefully measuring the location of the spots where the x-rays struck the emulsion after being "bounced" off the molecular layers of fibre structure, the scientist can, by proper application of mathematics, find out where the various atoms and molecules are and how they are arranged. He calls the picture on the photographic emulsion an x-ray diffraction diagram. By any other name it would mean as much to the uninitiated, but we are no longer wholly novices. We see that perhaps as indirect as the method appears, it is capable of producing interesting and valuable information.

Fibre, Fibril and Molecular Architecture

The textile manufacturer knows that twist variation along a yarn causes much variation and difficulty in the final fabric. He

is acquainted with the fact that twist can be increased only up to a certain point for any given yarn without weakening the yarn strength. True, certain yarns are habitually made with extra



(*a*) (*b*)

FIG. 24 (*a*). Arrangement of atoms in the long-chain molecule of cellulose. Compare the closed structure with the more open arrangement of the atoms in wool (Fig. 2).

(*b*) The wool molecules in their normal state are supposed to be "crimped" as at the left of the figure. After stretching they temporarily become straightened as at the right. Under proper conditions (time, temperature and moisture) they tend to revert to the original crimpy condition.

high twist, as in the manufacture of crêpes. On the other hand certain yarns are intentionally low twisted, as for knitting and as in silk and rayon. The low-twist yarns are in general soft and

flexible, while the highly twisted yarns are wiry and hard. So it is with fibres. The properties of the fibre depend in large measure upon the way in which the fibrils and long-chain molecules are combined in their ultimate structure.

In cotton, it is believed that these long-chain molecules are composed of closed links or groups of atoms, and if it were not for the fact that the fibrils twist about the fibre axis at angles comparable with those found in well twisted cotton yarns, the cotton fibre would be only slightly stretchable; would be brittle rather than tough. Many desirable properties such as these, which have made cotton an outstandingly important textile fibre for centuries, are due directly to the molecular structure of the fibre.

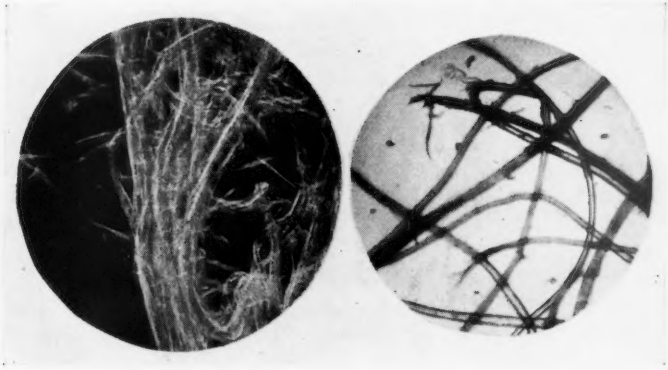
Wool, it is believed has a long-chain molecule which is made up of unclosed units, which, upon tensioning the fibre, open up and allow a considerable stretch to take place. Their normal position, however, is one of "crimp" rather like the wool fibre itself. When the tension is released (particularly in the presence of warmth which energizes the atoms of its structure, and moisture which perhaps acts somewhat like a lubricant) the fibre molecular chains return to their original condition. Because of the crimpy molecular chains in wool our Beau Brummels can renew the crease in their trousers, which, however, eventually will be lost again because of this same structure of the wool.

Wool differs from cotton in that it is composed of many tiny, spindle-like cells, pressed tightly together and held in place by an elastic sheath. Each of these tiny cells—just barely visible under the microscope—is composed of thousands of "crimped" molecular chains packed in tightly side by side. They behave like tiny springs to keep each cell down to its normal length and diameter.

Severe mechanical treatment of wool, as in the preparation of shoddy or mungo, frequently may separate these cells from each other. Certain micro-organisms can also do this. But it takes a chemical reaction of some sort to break up the cells into molecules, or, what is the same thing, to *dissolve* the fibre. Alkalis have this ability. Acids do not attack the cell molecular chains so readily, but they do help to separate the cells from one another. Morey, by treating the wool fibre in the unstretched

condition with dyes which become self-luminous in ultra violet light (dyes which fluoresce), was able to show that the dye molecules are lined up to a greater degree in stretched wool, and the dying is deeper than for unstretched wool.

Microscopical examination of wool, then, shows a certain similarity of structure with bast and leaf fibres in general. These likewise are composed of small spindle-shaped cells held together by a binding substance, but without the surrounding



(*a*) (*b*)

FIG. 25 (*a*). Wool fibres are composed in large part of tiny "spindle shaped" cells. The fibre shown in the photomicrograph has been broken up by the action of acid and pressure to show the packing together of these cells. Only a small portion of one wool fibre is shown here.

(*b*) Severe mechanical treatment of wool fibre as in the preparation of shoddy or mungo is indicated above. The spindle cells are separating out at the points of greatest damage.

elastic sheath. Each cell, in turn, is composed of fibrils which may be nearly parallel with the longitudinal axis of the cell, as in flax and ramie; or which may be at an angle with the cell axis, as in jute and manila. Again the fibrils are composed of long-chain molecules packed together in bundles. (Sometimes these bundles are called "micelles.")

Silk is not quite the same as either wool or cotton in its architecture. It is composed of fibrils which are relatively long.

When these fibrils are released from their close packing by reason of chemical or mechanical damage, as in too severe treatment during the "soaking" process preparatory to "throwing" into yarn, they tangle with each other and produce a so-called silk "louse." This is much like the cotton "nep," or tangle of immature fibres. The long-chain molecules which make up silk fibrils are probably neither straight, as in cotton, nor crimped, as in wool. Rather, they seem to be mildly "accordion

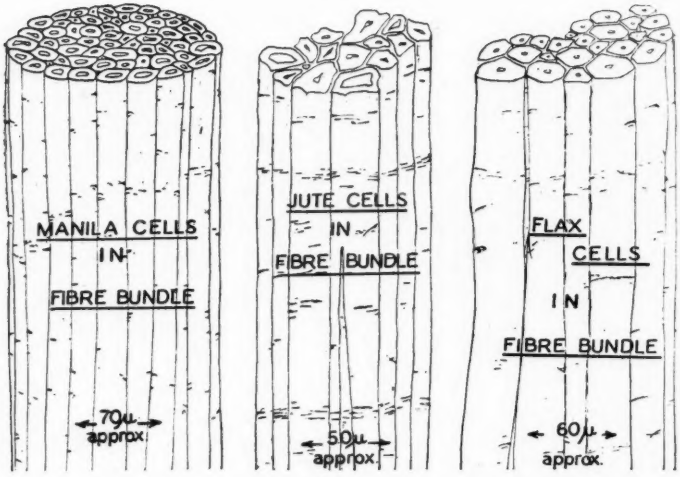


FIG. 26. Bast fibres and leaf fibres also are composed of spindle-shaped cells, closely packed to form the usual commercial fibre. These cells are very much larger than wool fibre cells and are seen easily in the cross-section of the fibre, when viewed through the microscope. Wool cells cannot be so seen.

pleated." Thus, silk stretches readily and recovers its stretch with reasonable completeness when the tension is released. Silk behaves as would an accordion surrounded with elastic bands, when opened or closed.

It is interesting to note the striking similarity between the nature of the molecular structure (the framing of the long molecules) and the structure of the resulting fibre itself, shown by these pictures. Crimped molecules produce a fibre which itself

tends to be crimped, as in wool. Twisted fibrils, made up of straight molecules, produce a twisted, but relatively inextensible cotton fibre. Long fibrils, twisted slightly into flexible and elastic molecules, are manufactured by the silk worm. Well may we study fibre, fibril and molecular architecture for the valuable information it can give as to the reasons for the unique behavior of the different fibres, yarns and fabrics.

Nowadays it is not enough to know WHAT. We must also find out HOW and WHY. Otherwise we can not progress. Frequently the HOWS and the WHYS are complicated. Trained scientists must explain the facts. They must use their best judgment in doing so, lest they be like the would-be scientist who celebrated some change in his fortunes by imbibing too freely of whiskey and soda. The resulting "hangover" left him sad. On the next occasion for celebration he tried gin and soda. The result was equally painful. Once more he experimented; this time with brandy and soda. The morning after was no brighter. Then he sat himself down with the facts to think. The one common factor apparent on the surface of things was soda (so he reasoned). Hence, he concluded that, to avoid a "hangover" in the future, he would take all his drinks straight. He discovered his error too late. The common factor was not the self-evident soda, but the less obviously present alcohol. Thus it is well to have the findings of the scientist presented in comprehensible fashion to the textile manufacturer that he may, with his hard-earned knowledge, get at the real facts without the danger of a "technical hangover" because of lack of adequate understanding of the findings.

Mind-Numbing Vastness of Solar and Atomic Systems

We have discussed briefly some details regarding fibres, fibrils and long-chain molecules and their combined relationships. How do we know that these things are so? The answer is that we do not know all about fibres, fibrils and long-chain molecules, but we are in a position, due to recent advances in science, to obtain more and more information. No longer do we believe that the chemist can give us a complete picture of the structure of fibres. He can tell us a great deal, however, about the varieties of atoms found in fibres. He can tell us whether or not cer-

tain of the theories of fibre structure are sound, and whether they explain *all* of the known chemical facts about fibres.

The scientist in the field of physics is in a position to study many of the details as to the arrangement of the atoms which the chemist knows are there. He can not see them, but neither can the electrical engineer see electricity. Neither the physicist nor the chemist knows exactly *what* is in the atom. They do know *how* atoms behave, just as the electrical engineer knows *how* electricity behaves, but does not know exactly *what* it is. One thing in common is the fact that atoms and electricity, x-rays and light, in the last analysis, are forms of energy.

In much the same fashion that the mind-numbing immensity of the solar systems of the astronomer with their suns and planets can be compared with the equally unbelievably small atomic systems of the chemist each with its nucleus and surrounding electrons, can a comparison be made between the structure of the fibre and the structure of the molecule that makes it up. The suns and planets are, after all, made up of nuclei and of electrons. The atom-splitter, as the modern physicist is often called, has much in common with his brother the astronomer. The textile manufacturer, similarly, should have much in common with the investigator of molecular structure, for the latter deals with the ultimate units of composition of the fibres which are the former's means of livelihood. While the figure which estimates the number of electrons which could be packed into the known universe (namely, 100 000 000 000 000 000 000 000 000 000 000 000 000 000 000 000 000 000 000 000 000 000 000 000 000 000 000 000 000 000 000 000 000 000 000 000 000) is very much bigger than the number of electrons in a wool fibre, these numbers deal with manifestations of exactly the same kind of energy. In announcing the tremendous number just noted, Dr. K. T. Compton, president of the Massachusetts Institute of Technology, stated, "progress comes not by revolution or discarding of past knowledge and experience but is built upon past experience and is its natural extension *once the vision from new vantage points is secured.*"

The textile manufacturer's vision is made broader in its scope by the dawning recognition of the fact that he is clothing

mankind with the very stuff that stars are made of. Literally, for textile research, then, "The sky's the limit!"

Coming back to earth, the scientists play a rather mean trick on nature by using some of these forms of energy to find out what the real nature of the other sorts are. The textile technolo-

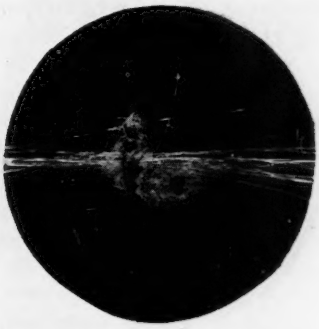


FIG. 27. A tangled mass of fibrils and filaments on a silk yarn forms what is known as a silk "louse."

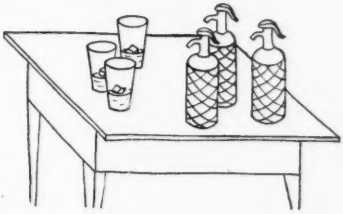


FIG. 28. While soda may be an obvious common ingredient of three types of mixed drinks, it should not be forgotten that alcohol is also present in all three. Care must be used in the interpretation of experimental results to avoid a "technical hangover."

gist bombards the atoms of textile fibres with x-rays which are so small that they easily bounce off the layers of atoms and land on a photographic plate or film, thus recording their final positions. Just as a navigator, far out of sight of land, can compute his position and know exactly where his home port and destination are, even though he cannot see them, so can the x-ray spectrog-

rapher tell from these photographs (or fibre diagrams) where the atoms which changed the direction of the x-ray beam must be, how far apart they are, and how they are lined up.

But the very smallness of x-rays makes it difficult to tell exactly how the molecules are made up of atoms, when these molecules are as big as they are in the fibres. The chemist must await the full story while the x-ray investigation develops new methods and longer wave length (or as he says, softer)—beams of energy. Briefly, the chemist feels sure that the atoms which form the ends of the long molecules must be different in arrangement from those which form the body of the molecule, just as the fibres of cotton, wool, flax, or jute are known to be different from each other at their ends. By attaching known atoms, like tags, to the ends of the molecules, and then determining how many tags there are, the chemist finds out how many ends are present. By attaching similar tags along the sides of the molecules, knowing which atoms possess affinity for his atomic labels, he is becoming aware of how many groups of atoms form the molecule. Now, taking the length of the group for cellulose as measured by means of x-rays, or 10.3 Å, (2,500,000,000 of these groups could lie end on end in one inch) he is beginning to gain information as to how long the chain of groups may be.

Correlation of Yarn and Molecular Fibre Structure

What of it? Well, the longer these chains are, the stronger the fibre; just as the longer the staple of the fibre, the stronger the yarn. In making rayon, the cellulose from wood or cotton is broken down (or degraded) into short-length molecules by proper chemical treatment. The molecules are so shortened that they can be carried conveniently in a liquid, forced through the holes in the spinnaret and then re-combined to form filaments. If the length and arrangement of the final molecules of rayon could be definitely controlled, much better rayon would immediately be available. The "stretch spinning" process tends to arrange the molecules, or at least a reasonable number of them, parallel with the fibre axis and with each other. The rayon manufacturer tries to do what the worsted manufacturer does with wool fibres, as opposed to the process used by the woolen manufacturer. In woolen yarn the wool fibres lie at a wide

variety of angles with each other, producing a relatively fuzzy and weak strand. In making worsted yarn, pains are taken to have the fibres of wool as nearly parallel as possible. A fine, smooth, strong yarn results. To make a good worsted yarn it is not enough to have simply parallelism. Short fibre must be removed by combing. Unfortunately, the worsted manufacturer

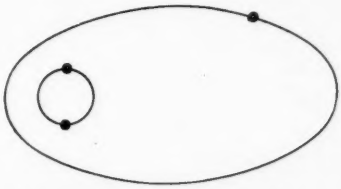


FIG. 29. Physicists conceive of an atom as made up of a nucleus and several electrons. Positions of electrons in a hypothetical lithium atom are shown here.

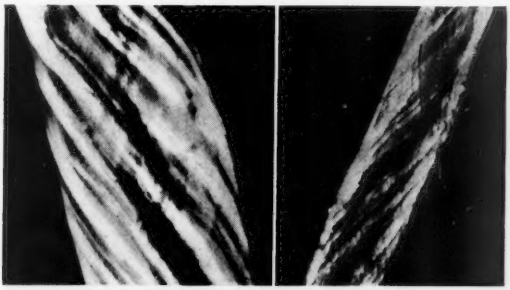


FIG. 30. Flax (left) and jute (right) disintegrated to show molecular structure. Notice that the direction of the spirals is opposite in the pictures. How much do these fibrils and molecules stretch and how much do they slip when the fibre is stressed? Why do they always spiral in a given direction for one fibre and in the opposite direction for another? Many such questions remain to be answered.

cannot increase the length of his fibres, but he can eliminate the short ones. The rayon physicist stretches the rayon filament to attain parallelism of molecules, just as the yarn manufacturer drafts his strand to obtain parallel fibres. Further, the problem of obtaining sufficiently long molecules faces the rayon chemist. He *can* hope to control their length. He can even hope to in-

crease their length, but he will be able to do this only after more research has shown how nature in the guise of earthbound plant for cotton, silly sheep for wool, and lowly worm for silk can make long molecules and build them into fibres.

A serious difficulty which has faced the chemist in his search for information as to fibre structure is that he must destroy the thing which he is trying to examine. In these circumstances the pre-existence of certain details of structure must be argued upon the basis of acts of disruption and must be interpreted with caution. A certain amount of similar difficulty is experienced by the microscopist, but with the aid of x-ray diffraction analysis, fluorescence studies, and polarized light the behavior of the small units of structure can be observed without damaging them.

If a stress is applied to a swollen fibre, the fibre "flows" as does any viscous material. The x-ray pattern does not change except to show variation in intensity distribution around the diffraction ring, indicating a change in orientation of the groups of molecules. If the crystalline pattern had been disrupted by the swelling, as it is in metals, the spacing of the rings would be altered. Because this does not occur, it is inferred that the groups of molecules must move as units—slipping by each other. They behave very much as do the fibres in a spun yarn which is subjected to tension in a testing machine. There seems to be no escaping from the parallel between the structure of fibres and the structure of yarns.

Examination of the cross sections of rayon filaments with polarized light shows what appears to be a grouping of similarly oriented molecules or molecular clusters. How much of the original "natural" fibre structure is carried through the dissolving, spinning and regenerating processes? Is there any recrystallization during the regeneration? These questions will be answered in the near future in the light of further investigations using all (and perhaps other) of these forms of energy for the accumulation of facts.

Any textile mill man knows that textile raw materials are notable for their inherent variability. In the last analysis the variation can be traced back in large measure to the faults of structure in the individual fibres. These faults are due to irregularities of molecular arrangement locally. As yet the x-ray

technique is not sufficiently developed to make possible analysis of conditions at any localized spot on a single filament. Since, however, the fluorescence technique involves the use of a high-

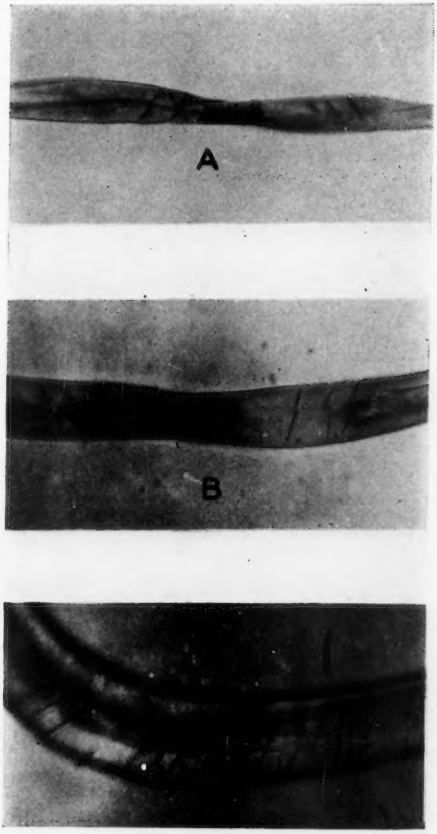


FIG. 31. Cracks and faults in cotton fibres as they appear under a high power microscope lens. Such irregularities contribute in no small measure to the variability of textile materials.

powered microscope, which can very effectively isolate a very small bit of the fibre in its field of view, the changes of molecular orientation can be studied progressively along a fibre, and the

points of fault can be pointed out. Such observations can be checked in polarized light. Direct-color photomicrography makes possible a permanent record of such changes of color as are produced.

It is also possible to make celluloid casts of the surface of such fibres as flax and ramie to demonstrate conclusively that many of the defective portions, which have been considered more or less an optical illusion by earlier investigators, are really fissures. They are extraordinarily minute, but when the cast is removed from the fibre and greatly magnified the impressions can be studied readily. These fibre "finger prints" also make possible studies of the behavior of fibre surfaces during strain. A fibre can be subjected to tension and stretched slightly. While in this state, a cast is taken. The fibre is stretched still more and another impression made on a second minute fragment of celluloid. The casts are available for investigation at the worker's leisure and show the surface characteristics even more clearly than did the original fibre. It should be obvious that the nature of fibre surfaces is extremely important to the yarn spinner, because the strength and durability of the yarn are dependent upon the friction between fibres. This, in turn, is dependent upon the slightest variation in roughness of the filament. Since little work has been done in investigation of surfaces of fibre, here is a worthy field for research.

The Textile Technologist's Important Functions

More and more, textile research is becoming qantitative. It is not enough to ask simply "How?" The scientist must state not only *how* but *how much*. Thus, the sciences are combined. Thus, instruments are conceived, built and used. Thus, data is accumulated. But the work cannot and should not end here. Figures, diagrams, tables and charts representing the fruits of hours of painstaking research are of no value to the textile industry if they are simply filed away, or buried in a publication to which the industry does not have easy and customary access. Nor are they of real value, even when made properly accessible, if they cannot be understood and applied by the manufacturer.

Between the scientific investigator in his laboratory, on the one hand, and the manufacturer in his mill, on the other, now

stands the textile technologist. He it is who must take the information coming from the laboratory and make it usable and understandable. To do this he must have sound background in modern science. He must have the scientific approach to a problem. But he must also have a background of direct contact with the textile industry itself. He must know and ap-

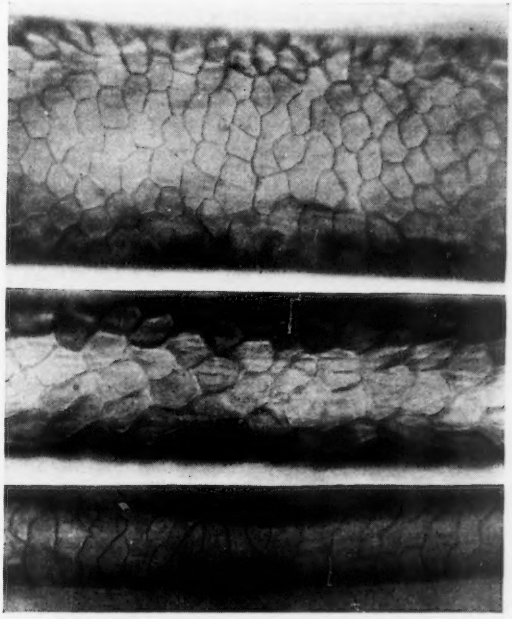


FIG. 32. Fibre "finger prints" are made by forming celluloid "casts" of the fibre surface. The photomicrograph shows impressions of two types of kemp (top) and or a normal wool fibre (bottom) in celluloid. The fibres had been removed before the pictures were taken.

preciate its problems. He must fully realize the "practical" side of the production of beautiful and useful fabrics.

Beyond this he must have the ability to translate the language of science into the language of the mill man. Only after such translation can the contributions of the research worker be made valuable to the industry. Men like this must be trained. They

must continuously be supplied with facts by research. They must have a sympathetic hearing by the manufacturer.

Quoting again from J. A. Thompson: "The scientific mood is especially marked by a passion for facts, by cautiousness of statement, by clearness of vision, and by a sense of the inter-relatedness of things. It is contrasted with the emotional or artistic mood and with the practical mood, but the three form a trinity (of knowing, feeling and doing), which should be unified in every normal life. . . . Much of practical lore is thoroughly scientific though it may never have been stated. The use of instruction is to make it conscious, communicable, and more plastic, and to get down to the principles which it unconsciously illustrates. For wonderful as is the lore that comes from instinctive insight to start with and long experience to back this up, it not only tends to die with its possessor, but like instinct, as contrasted with intelligence, in animal, it is apt to be thrown out of gear by some slight change in the conditions of application."

Textiles are rich in a heritage and a lore brought down through the ages. Spinning, weaving and dyeing were practiced long before there was a science of physics or a science of chemistry. But the tremendous increase of these under scientific stimulation is obvious. The tremendous growth of the synthetic dye and the rayon industries is a self-evident example.

Modern scientific research is developing such powerful means of attack on problems hitherto unsolved that adoption of the scientific approach to textile problems is now simply a matter of ordinary efficiency. The textile industry must merge itself with what the late Arthur D. Little called "the fifth estate . . . composed of those having the simplicity to wonder, the ability to question, the power to generalize, the capacity to apply. It is, in short, the company of thinkers, workers, expounders, and practitioners upon which the world is absolutely dependent for the preservation and advancement of that organized knowledge which we call science."

Needle Type Thickness Gauge

By J. N. DOW*

CONVENTIONAL instruments for measuring the thickness of fabrics or sheet materials consist of a base plate and a movable foot, the two connected by a rigid support in such a way that a dial gauge will indicate the distance between the movable foot and the surface of the base. The use of such gauges is limited by the dimensions of the base plate, and particularly by the length of the arm supporting the dial gauge and movable foot. In order to obtain the rigidity which is necessary for accurate measurements, most devices can measure the thickness of fabrics and sheet materials only near the outside edge. It has not been possible in the past to determine the thickness of heavy fabrics, such as carpet, near the center of wide pieces of material.

In order to overcome this difficulty a device has been worked out in the laboratories of the Bigelow-Sanford Carpet Company which makes it possible to determine the thickness of carpet and similar materials at any point over the surface of the fabric. This device indicates the distance between a foot, which rests on the upper surface of the fabric, and a needle point which penetrates through the fabric to the supporting surface below. Several different means of supporting the instrument have been developed for different applications and such gauges have found wide application both in the laboratory and in the plant for testing work and for quality-control work, respectively.

The device was originally developed for use with the Bureau of Standards' type of wear test machine so that the thickness could be determined without removing the fabric from the turntable. This gauge is shown in Fig. 1. In this case the turntable of the wear test machine is of steel which has been ground to a smooth finish. In making the thickness measurement, the dial gauge assembly, which includes the presser foot, the needle, and the dial gauge, and which is coupled through a rack and pinion to the supporting stand, is moved down against the carpet sample by means of a large knurled head. The head is turned with light pressure from the fingers until the needle makes contact with the metal plate. An electric indicator may be used to show when this contact is established, but this is not essential since there is a definite click when the needle touches the base plate.

A second application of this principle for measuring thickness is in the finishing and inspection rooms, where, for control purposes, it is necessary to measure the thickness of rugs and of large rolls of carpeting. For this purpose, metal or glass plates have been installed on the floors of the finishing and inspection rooms and in some cases in special inspection tables. The gauge which is used for this purpose is illustrated in Fig. 2. In this case the dial gauge, presser foot, and needle are coupled by means of a rack and pinion to an arm which is attached to a triangular cast-iron base frame. The rug or roll of carpeting is located so that the spot to be measured is directly over the metal plate. The thickness gauge is then set on the carpet

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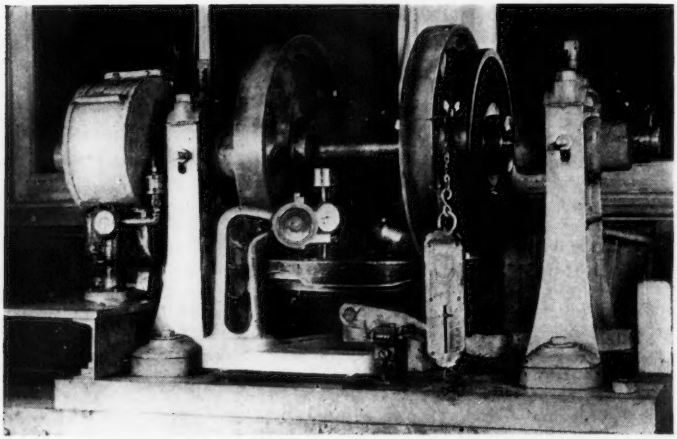

FIG. 1. Thickness Gauge for Use with the Bureau of Standards' Type of Carpet Wear Tester.

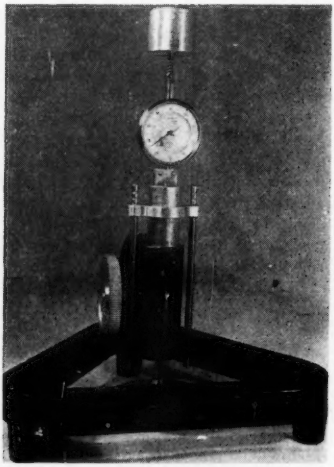

FIG. 2. Thickness Gauge for Rugs and Large Rolls of Carpet.

or rug over this point, and the needle and presser foot are lowered by means of the rack and pinion until the presser foot rests on the surface of the carpet. The lowering of the needle is continued until the latter penetrates the fabric and contacts the surface of the metal plate.

In both of the gauges described the thickness is read from the dial gauge after the needle point has contacted the base plate. In both gauges the dial can be rotated about a vertical axis to facilitate reading from any direction. Both gauges are fitted with a detachable weight to give the desired pressure on the carpet sample. The gauge for use with the wear test machine has a 1-in. diameter foot, and measurements are made at a pressure of 0.75 lbs. per square inch. The gauge for use in finishing and inspection rooms has a 3-in. diameter foot, and measurements are made at a pressure of 0.1 lb. per square inch.

An interesting feature of the gauge for finishing room and inspection room use is the spring arrangement which raises the presser foot and needle point assembly after the milled head has been released. This has been found important to minimize the breakage of the steel needles.

April 26, 1937.

(*Continued from P. 309.*)

"**Dyes vary enormously** in their ability to resist fading in sunlight, and while some dyes increase the tendency of cellulose to disintegrate on prolonged exposure to light others exert a definite protective action. If the reason *why* dyes behave so differently could be found a great step forward would have been made, and intensive research by the British Cotton Industry Research Association is in progress in the hope of supplying the answer to this question." *Tex. Mfr.*

* * *

European research laboratories, to be visited by the group of industrial and banking executives participating in the tour arranged by the Division of Engineering and Industrial Research of the National Research Council, includes those of the British Cotton Industry Research Association at Didsbury, and those of I. G. Farbenindustrie in Germany. The prospectus mentions among the notable results of research to be seen at the former, the selection of harmonious colors by use of a color chart based on the musical scale; and at the latter, the electronic study of chemical compounds in a vacuum. The party sailed from New York May 19.

* * *

Red-wooled Lambs.—"Twin lambs born on the John McKinney farm in Sullivan, Indiana, are normal in every respect except that they have bright red wool." This news item, quoted in the "This is Life" column of Prof. Robert E. Rogers in the *Boston Evening American*, was the text for a humorous dissertation on red flannels and transmutation of species. More to the point would have been a parody on "Mary had a little lamb." Every few years "sport" types of cotton of various colors are reported by southern planters who have visions of their reproduction in commercial volume. But just think of the possibilities of several generations of quintuplets "bred true" from McKinney's red-wooled twins—that is, if demand for red flannels can be revived.

Abstracts

Committee on Abstracts and Bibliography:
E. R. Schwarz, Chm., M. W. Weiss, Dr. I. J. Saxl, C. H. Clark.

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I. Fibres (Synthetic and Natural) and Fibre Analysis

Polymerization: Degree of—of Natural and Technical Celluloses. H. Staudinger and K. Feuerstein. *Annalen*, 1936, V. 526, P. 72–102; *J. Soc. Dyers Col.*, Feb. 1937, P. 74. (C)

Recovery of Wool Grease in the Bradford Trade. F. Brock. *J. T. I.*, Feb. 1937, P. P30–P39.

Lecture delivered at meeting of the Yorkshire Section of the Textile Institute, Bradford, Eng., Dec. 10, 1936. (C)

Structure of Fibres of Straw, Alpha Grass, Linen and Cotton. R. Michel-Jaffard. *Chim. et Ind.*, 1936, V. 36, P. 115–23T, 879–87; *J. Soc. Dyers Col.*, Feb. 1937, P. 75.

Moderate action of cuprammonium permits the classification, in agreement with their technical properties, of straw with linen, and of Alpha grass with cotton. Thus, straw and linen are characterized by separating into layers parallel to the fibre axis, while Alpha grass and cotton exhibit periodic deformations of the lumen. It is suggested that these deformations are due to differences in the softening effect of water on the different elements constituting the fibre structure. This hypothesis is in agreement with the deformation of the fibres which occurs on bending and twisting in water; linen and straw fibres being characterized by their

rigidity, and those of Alpha grass and cotton by their suppleness. Excellent photomicrographs are included. (C)

VEGETABLE CELL WALLS: GROWTH OF. W. Wergin. *Angew. Chem.*, 1936, V. 49, P. 843–5; *J. Soc. Dyers Col.*, Feb. 1937, P. 75.

During the growth of the cotton hair, two crystalline constituents are present, the first of which is not orientated and is quite distinct from cellulose, while the second is arranged longitudinally along the fibre axis. (C)

WOOL COMBING: SUBSTITUTES FOR OLIVE OIL IN. *Rev. Text.*, 1936, V. 34, P. 145–7.

A discussion on the theoretical aspects of removal of oil from wool, with special reference to agents, *e.g.*, oleyl alcohol and stearamide, suitable for adding to mineral oils to assist in their removal in scouring. (From *J. T. I.*, Jan. 1937, P. A9.) (C)

WOOL: REACTION OF—WITH STRONG SOLUTIONS OF SULFURIC ACID. Milton Harris, Ralph Mease and Henry Rutherford. *B. S. J. Rsch.*, March 1937, P. 343–50.

It has been shown that wool reacts with strong sulfuric acid to form a relatively stable compound. The combined acid cannot be removed by prolonged washing with water or alkaline reagents. An investigation was, therefore, undertaken at the Bureau to determine the nature of the reaction and to study some of the properties of its product. Data have been secured on the way wool is affected by treatment with solutions of sulfuric acid of different concentrations at 5, 25, and 50° C for 15 min., and with an 80% solution of sulfuric acid at 25° C for different lengths of time. The results suggest that strong sulfuric acid reacts with the basic groups in wool to form sulfamic acid derivatives. The acid-combining capacity decreases and the base-combining capacity increases in proportion to the number of sulfamic acid groups formed in the wool. (C)

II. YARNS AND FABRICS

ACCURACY IN CLOTH LENGTH MEASUREMENT. A. and H. Simonett, Ltd. *Tex. Mfr.*, Dec. 1936, P. 468.

A new cloth doubling and rolling or lapping machine, which has automatic selvedge guiding, is fitted with new measuring devices for tensionless measurement of fabrics, with great accuracy claimed. (C)

ACETATE: THE ULTIMATE. N. C. Thayer, Jr. *Rayon Tex. Mo.*, Sept. 1936, P. 33, 40. (C)

ATMOSPHERIC HUMIDITY AND YARN REGAIN: RELATIONS BETWEEN. R. Setzer. *Mell. Textilber.*, 1936, P. 191; *Rayon Tex. Mo.*, July 1936, P. 85.

The relations between the moisture content of fibres and yarns and atmospheric humidity have often been the subject of investigation, but these researches have not been brought to a final conclusion, so that, for

the most part, they cannot be applied in operating practice. The author has attempted to fill that gap and adapt the results obtained for the manufacture of cotton and cotton yarn, the aim being to make it possible always to determine the correct atmospheric humidity, in spite of variations in the temperature. By the aid of numerous diagrams, the author shows to what extent Egyptian and American cotton are dependent upon the moisture content of the fibres (regain), the temperature of the shed, and the relative atmospheric humidity. (C)

COATED FABRICS: USE OF SUITABLE EQUIPMENT SIMPLIFIES PRODUCTION OF. John T. Gibbons. *Tex. Wld.*, Nov. 1936, P. 92–3.

Deals with the methods and equipment used in the application of coatings to sheetings, ducks, drills, twills, and other fabrics. (C)

CONTINUOUS PIECE-GOODS CARBONIZING MACHINE. Wm. Whiteley and Sons Ltd. *Tex. Mfr.*, Dec. 1936, P. 473.

Blankets, flannels and other woolen fabrics are treated continuously and in open-width for impregnation, drying and carbonizing. (C)

CONTRACTION IN SYNTHETIC YARNS. Anon. *Am. W. & C. Rptr.*, Feb. 4, 1937, P. 7–8, 39.

Tabulated data is presented showing that number of filaments or denier of individual filaments affect percentage of yarn contraction in twisting. Indicates desirability of further scientific study. (C)

CONTROLLED SHRINKAGE CLOTH DRYING MACHINE. Spooner Dryer and Engineering Co., Ltd. *Tex. Merc. and Argus*, 1936, V. 95, P. 9.

In this vertical dryer the cloth is not hung in festoons but over driven rollers and the hot air is directed at the cloth in powerful jets. The machine is therefore much smaller than the usual dryers. The cloth is shrunk to a maximum amount and may then be slightly stretched to remove creases. (From *J. T. I.*, Aug. 1936, P. A378.) (C)

COTTON CLASSER'S MICROSCOPE: DETERMINING THE MATURITY OF COTTON BY USE OF THE. E. R. Schwarz. *Cotton*, Jan. 1937, P. 60–2.

A practical discussion of the subject with special reference to identification of neppy immature cotton. (C)

COTTON ORGANIZATIONS: TRIAL AND ERROR NECESSARY TO SOME EXTENT IN CALCULATING. Gilbert R. Merrill. *Tex. Wld.*, Aug. 1936, P. 64–5.

In this fourth of a series of articles on calculating cotton-yarn organizations, Prof. Merrill describes the experimental figuring which is usually necessary to secure the results wanted; and he also explains the "standard-draft" method, which is founded on a proportioning of the required drafts with certain basic drafts. (C)

COTTON WARP SIZING: NOTES ON. Ralph Hart. *Rayon Tex. Mo.*, 1936, June, P. 47–8; July, P. 57–60; Aug., P. 33–6; Sept., P. 128–9; Oct., P. 58–9. (C)

COTTON SLASHING AND WARP PREPARATION. J. M. Bolt. *Rayon Tex. Mo.*, Aug. 1936, P. 55–7.

A number of causes of inefficient sizing and methods for their elimination are given. The author, a practical man, expresses the belief "that more yarn is ruined in the slasher room than anywhere else in the average cotton mill." (C)

DE-ELECTRIFICATION OF RAYON. *Spinner u. Weber*, 1936, No. 9, P. 14; *Rayon Tex. Mo.*, Sept. 1936, P. 141.

The remedy proposed is neutralizing the electric charges on the fabrics by means of rods maintained at high potentials which ionize the air in the neighborhood of the textile material. (C)

DESTRUCTION OF RAYON AND MIXED FABRICS BY FUNGI, BACTERIA AND INSECTS. S. Urban. *Deut. Wollen-Gewerbe*, 1936, V. 68, P. 1231–4.

The results of several reports are reviewed. In storing yarns and fabrics the air humidity and temp. should be low and the air should be fresh. Good ventilation and cleanliness are the best means of preventing the formation of molds. Various causes of mold formation during manuf. are pointed out. A useful antiseptic to be added to the finishing baths is *p*-chloro-*m*-cresol (called Raschit commercially) which is a better disinfectant than $HgCl_2$ and has the advantage of being nonpoisonous to man. (From *C. A.*, 1936, V. 30, Col. 7860.) (W)

DRAFTING COTTON FIBRES: "RICHARDSON" SYSTEM OF. R. P. Richardson. *Tex. Mfr.*, Nov. 1936, P. 410.

A new point of view on drafting of cotton or staple fibre, allowing less machinery and claiming improved yarn evenness and strength. (C)

DRYING OF RAYON SKEIN: PROGRESS IN CONTROLLED. Birney Miller. *Rayon Tex. Mo.*, 1936, Sept., P. 92–3; Oct., P. 50–1. (C)

FAULTS IN RAYON GOODS. V. J. M. Preston. *Tex. Mfr.*, Sept. 1936, P. 342–3.

This fifth article of the series treats of types of faults not showing periodicities arising from faulty yarn. (C)

FELT ADVANCES WITH CHEMICAL DEVELOPMENTS. *Am. Dye. Rptr.*, Nov. 30, 1936, P. 650–1. (C)

FILLING BOBBINS OR QUILLS: FLAT VS. ROUND—FOR WEAVING RAYON FABRICS. H. R. Mauersberger. *Rayon Tex. Mo.*, Sept. 1936, P. 89–91. (C)

FLAME-PROOFING OF FABRICS: NEW DEVELOPMENT IN THE. N. L. Deutsch. *Rayon Tex. Mo.*, 1936, Oct., P. 69–70; Nov., P. 69–70. (C).

FLAT QUILL. *Tex. Wld.*, Nov. 1936, P. 78–9.

Introduced to this country from Switzerland to increase rayon and silk shuttle capacity. (C)

HUMIDITY AND ITS CONTROL IN TEXTILE PROCESSES. *Rayon Tex. Mo.*, Sept. 1936, P. 101–3, 107. (C)

KNITTED FABRICS: SOME PHYSICAL PROPERTIES OF. II. RELATIONS OF FABRIC THICKNESS TO YARN PROPERTIES. C. H. Edwards. *J. T. I.*, Aug. 1936, P. T207–T215.

The previous part of this survey (*J. T. I.*, 1934, V. 25, P. T277) dealt with the thickness and weight relations of a miscellaneous range of fabrics from the standpoint of methods of fabric structure and the materials used. The work now described concerns the relations of yarn count, twist and diameter to the thickness of the resulting fabrics produced on three characteristic types of knitting machine and is confined to cotton yarns knitted in plain stitch. The results of the experiments are summarized as follows: (1) Fabric thickness depends on the spirality as well as other characteristics and changes in one of these factors are generally opposed by changes in the others. Thus, stiffening of the knitted texture produces less increase of thickness than might be expected owing to loss of spirality. (2) Fabric thickness increases with yarn twist although the yarn diameter decreases. (3) The thicknesses of corresponding types of fabric are not in the ratio indicated by the yarn counts and diameters, finer yarns giving relatively thicker fabrics. This is particularly emphasized by low pressure measurements. (4) Three numerical systems are available for expressing fabric hardness or compressibility and are of equal merit; all indicate that the hardness of fabrics increases with yarn twist and count. (5) Fabric thickness varies with the texture of knitting and is approximately greatest for the texture which is considered normal for a particular machine and count of yarn. (C)

LUBRICATION IN THE WORSTED TRADE. H. E. Franz. *Mell. Textilber.*, 1936, P. 399; *Rayon Tex. Mo.*, Sept. 1936, P. 141.

Deals particularly with paraffin emulsions. It has long been known in the textile trade that paraffin is a good bleaching agent, the only reason that it has not been more popular being that it is difficult to remove in the finishing. It is claimed that all difficulties vanish as soon as paraffin has been converted into a form which is soluble in water. Describes a wool cream under the trade name "Praelanol" which consists of an emulsion of paraffin. (C)

MILDEW: GROWTH AND INHIBITION OF. J. F. Holmes. *Tex. Col.*, Nov. 1936, P. 737–8, 773. (C)

PERLOK YARN. E. D. Fowle. *Tex. Wld.*, Dec. 1936, P. 68–70.

Describes the Perlok machine for converting continuous groups of rayon filaments by a breaking process into roving, also describes the principles involved, and character of the product. (C)

PRINT-CLOTH YARN: CALCULATING A MACHINERY ORGANIZATION FOR. Gilbert R. Merrill. *Tex. Wld.*, Nov. 1936, P. 80. (C)

RAYON AND OTHER YARN SIZES: NEW TYPES OF. *Tex. Mfr.*, Oct. 1936, P. 376.

German efforts at substitution of the linseed oil type of size for rayon and other warps. Acknowledging that linseed oil has never been entirely

satisfactory as a basis for size, although extensively used in Germany, the author describes three types of product which have already met with some degree of success. The first type comprises a protein degradation product in combination with oils and synthetic resins; the second comprises a synthetic resin of the phenol-formaldehyde type in combination with a hydrogenated hydrocarbon; the third type comprises a number of polyglycerine compounds, *i.e.*, polymers of unsaturated fatty acids. (C)

RAYON: HANDLING OF—FOR WEAVING. A. Glover. *Tex. Mfr.*, 1936, Nov., P. 420, 432; Dec., P. 459.

Another view and hints on the precautions necessary in the handling and weaving of rayon. (C)

RAYON: IDENTIFICATION OF FABRICS HELD FAVORABLE TO. S. R. Fuller, Jr. *Rayon Tex. Mo.*, Sept. 1936, P. 32. (C)

RAYON STAPLE. F. Bonnet. *Am. Dye. Rptr.*, Nov. 30, 1936, P. 645–6. (C)

RAYON STAPLE: MAKING YARNS AND CLOTH FROM. Edward King. *Cotton*, Dec. 1936, P. 58–61; Jan. 1937, P. 55–7.

A practical discussion of the subject. (C)

RAYON THROWING: PROGRESS IN. Irving J. Saxl. *Rayon Tex. Mo.*, 1936, Sept., P. 58–60; Oct., P. 47–9. (C)

RAYON WARP SLASHING: HIGH SPEED. I. G. Sanford. *Rayon Tex. Mo.*, Aug. 1936, P. 67. (C)

SCOURING OF RAW WOOL: PRACTICE AND THEORY IN. I–II. T. E. Thompson. *Tex. Mfr.*, Dec. 1936, P. 451–2; Jan. 1937, P. 5–6.

Gives a considerable amount of new information which is applicable to the scouring of wool. A modern review of the subject is also given. (C)

SINGLE WORSTED YARNS AND FABRICS. S. Kershaw and G. Haigh. *Tex. Mfr.*, Dec. 1936, P. 457–8.

Describes progress that has been made in spinning and manufacturing single-yarn worsted goods of soft handle and light weight. Methods and possibilities are discussed. (C)

SIZE IN WARPS: FINDING THE PERCENTAGE OF. *Cotton*, Jan. 1937, P. 66–7. (C)

SPUN RAYON FABRICS: PROGRESS IN—HERE AND ABROAD. Alexis Sommaripa. *Rayon Tex. Mo.*, Sept. 1936, P. 34–5, 37. (C)

STAPLE RAYON BECOMES IMPORTANT FACTOR HERE AS WELL AS ABROAD. E. K. W. Schwarz. *Rayon Tex. Mo.*, Sept. 1936, P. 81–3. (C)

STEAMING OF CRÊPE YARNS. J. Brandwood. *Tex. Mfr.*, July 1936, P. 265.

A vacuum vessel for yarn steaming is exhausted before admitting steam so that steam is economized and better penetration assured. (C)

TEXTILE DRYING: PROBLEMS OF. *Tex. Mfr.*, 1936, July, P. 276–7, Aug., P. 315–6.

Abstracts of papers presented at the conference on this subject held by U. S. Institute for Textile Research in May, 1936. (C)

TEXTILES AND THE WHEEL: ORIGIN OF. William F. Parish. *Rayon Tex. Mo.*, 1936, Sept., P. 49–52; Oct., P. 33–6. (C)

THREAD TENSION MEASUREMENTS ON FLYFRAMES. F. Oertel. *Mell. Textilber.*, 1936, P. 471; *Rayon Tex. Mo.*, Sept. 1936, P. 142.

The author made use of an electrical tension recorder for his measurements of the thread tension. Practical tests have confirmed the theoretical view of the changes that take place in the thread tension. It has further been found that the thread tension meter is useful not only for adjusting the machine, but also indicates how the design of the machine can be improved. (C)

THROWING: LARGE-PACKAGE—OF SILK AND RAYON AND PACKAGE-TO-PACKAGE OPERATIONS CUT COSTS IN HALF. I. G. Sanford. *Tex. Wld.*, Aug. 1936, P. 66–7.

THROWING RAYON YARNS: TRENDS IN. H. R. Mauersberger. *Rayon Tex.* Mo., Nov. 1936, P. 54, 75. (C)

TWIST: SHALL—BE BALANCED? A. K. Landau. *Tex. Wld.*, Dec. 1936, P. 723.

The author doesn't pretend to know the universal answer (if there is one) to the problem of securing the correct relationship between single and ply twists for all purposes, but sheds some light on the factors involved and urges that cotton mills engage in more research on the subject. (C)

WARPING FINE RAYON YARNS: COTTON VS. SILK SYSTEM. H. R. Mauersberger. *Rayon Tex. Mo.*, 1936, Sept., P. 84–6; Oct., P. 52–5. (C)

WOOL: RESEARCH NOTES ON. J. S. Brown. *Tex. Col.*, 1936, Aug., P. 553–6, 569; Sept., P. 621–5; Nov., P. 739–42; Jan. 1937, P. 86–9.

A review with interesting and instructive comments upon such varied subjects as wool lubrication; scouring; fibre structure; kemps; drying, carbonizing, testing, grading, finishing and wool properties. (C)

WOOL: USE OF STAPLE FIBRE IN CONJUNCTION WITH. H. Ashton. *Tex. Mfr.*, Nov. 1936, P. 414–5.

Lecture to the Bradford Textile Society, Oct. 19, 1936. (C)

TEXTILE RAW MATERIALS AND PRODUCTS: RECOGNITION AND EXAMINATION OF FAULTS IN. (German). A. Herzog and P. A. Koch. *Mell. Textilber.*, 1936, P. 533, 613.

Continuation of the extensive series of articles by the above authors and deals mainly with weaving faults, in particular those occurring in designs which can be recognized by irregularities in the weave. There are

a number of excellent photographs to illustrate the various faults. The origin of each fault is given and the best way of dealing with it noted. An unusual feature of the article is a discussion of the numerous faults that occur in pile fabrics.

The authors also deal with broken picks, traverse streaks and bands, pressure marks on pile fabric, and tangled pile thread, and lack of neatness on the back of the cloth. The weaving section concludes with the faults that occur in terry cloth, leno and gauze fabric. The next section is intended to deal with faults in braiding. (S)

THREAD TENSION CONDITIONS WITH N AND C TRAVELLERS (German). F. Oertel. *Mell. Textilber.*, 1936, P. 553.

It is noted that the position of the ring traveller on the cotton spinning frame is not constant so that variations in tension arise which may injure the yarn. C travellers are especially apt to show such variations and a new form of traveller known as the N traveller has been designed. The peculiar shape of this traveller is intended to keep the center of gravity lower. The author undertook the task of determining the changes in tension that take place with the various types of travellers by means of the electrically recording thread tension measuring instrument of the Siemens-Schuckertwerke. The curves produced by this instrument indicate that the N traveller does not run more quietly but that it can be made rather heavier than the C traveller so that the yarn is wound more firmly on the bobbin. (S)

III. CHEMICAL AND OTHER PROCESSING (NOT OTHERWISE CLASSIFIED)

BLEACHING OF COTTON GOODS. *Tex. Mfr.*, Jan. 1937, P. 29.

A review of the position in development of the hypochlorite and other processes. (C)

CAPILLARITY: INFLUENCE OF—UPON THE DYEING OF TEXTILES. Hans J. Henk. *Klepzig's Textil-Z.*, 1936, V. 39, P. 662; *C. A.*, 1937, V. 31, Col. 543. (W)

CAUSTIC POTASH VS. CAUSTIC SODA. NEW FACTS CONCERNING THE BEHAVIOR OF COTTON AND VISCOSE RAYON TOWARD CAUSTIC POTASH. A. J. Hall. *Tex. Merc. & Argus*, 1936. V. 95, P. 289, 293; *C. A.*, 1937, V. 31, Col. 546. (W)

CHLORINE BLEACH: STUDIES OF THE. W. Minajeff. *Mell. Textilber.*, 1936, P. 219; *Rayon Tex. Mo.*, Sept. 1936, P. 142.

All modern bleaching processes aim at allowing the free HOCl required to develop in the bleaching liquor, as is done in a practically perfect manner by the addition of $NaHCO_3$ to the hypochlorite solution. The opinion is expressed that the bleaching liquor produced by adding sodium bicarbonate to the hypochlorite solution is more effective than a pure hypochlorite solution in every respect, whether in regard to the bleaching effect for the same consumption of chlorine, the duration of the process, or the gentle treatment of the fibres. That method also makes it unnecessary to

sour the goods after treatment with chlorine, or at least goods that have been sized and kier boiled. (C)

COTTON BLEACHING AND FINISHING INDUSTRIES: RECENT DEVELOPMENTS IN THE. J. Andrew Clark. *Am. Dye. Rptr.*, Nov. 30, 1936, P. 648–9. (C)

COTTON: DYEING, APPLICATION OF PRINGSHEIM'S RULE. P. P. Sazanoff. *Textilber.*, 1936, V. 17, P. 421–3; *J. T. I.*, Aug. 1936, P. A379.

Pringsheim's rule for the deposition of precipitates by reactions in gels is discussed and it is shown by a study of the results of experiments that his rule also applies in the precipitation of dyes in cotton. (C)

DYEING RUBBER-CONTAINING YARNS AND FABRICS. ESSENTIAL SAFEGUARDS DURING HANK AND PIECE DYEING. E. R. Stamp. *Tex. Wkly.*, 1936, V. 18, P. 343, 345, 371; *C. A.*, 1937, V. 31, Col. 261. (W)

DYEING OF FEATHERS. Kuno Rickert. *Deut. Färber-Ztg.*, 1936, V. 72, P. 385; *C. A.*, 1937. V. 31, Col. 261. (W)

DYEING OF MIXTURES OF SPUN RAYON AND WOOL. Hans Jirk. *Monatschr. Textil-Ind.*, 1936, V. 51, P. 240–2; *C. A.*, 1937, V. 31, Col. 261. (W)

DYEING OF NATURAL SILK AND RAYON. F. S. Tomlinson. *J. Soc. Dyers Col.*, 1936, V. 52, P. 373–8; *C. A.*, 1937, V. 31, Col. 260.

A summary dealing with the dyeing of natural silk, viscose rayon, union fabrics, staple fibre, unions contg. cellulose acetate rayon and unions of animal fibres and cotton or viscose rayon. (W)

DYEING NATURAL SILK BLACK: NEW METHODS FOR. H. Schmidt. *Deut. Färber-Ztg.*, 1936, V. 72, P. 229–30; *C. A.*, 1937, V. 31, Col. 260. (W)

DYEING OF RAYON DURING THE SPINNING OPERATION. G. Salzmann. *Deut. Färber-Ztg.*, 1936, V. 72, P. 195–6; *C. A.*, 1937, V. 31, Col. 261.

A review of patents. (W)

DYEING, PRINTING AND FINISHING: NEW DEVELOPMENTS IN. E. K. W. Schwarz. *Rayon Tex. Mo.*, Sept. 1936, P. 104–7.

DYES AND CHEMICALS: NEW. Winn W. Chase. *Tex. Wld.*, Nov. 1936, P. 89–91. (C)

DYEING STAPLE RAYON: ATTENTION TO DETAILS WILL PREVENT UNDESIRABLE HAIRY FABRIC SURFACE IN. L. A. Jordan. *Tex. Wld.*, Aug. 1936, P. 69–70. (C)

DYEING OF SPUN RAYONS. George Rudolph. *Monatschr. Textil-Ind.*, V. 51, Fachheft II, July 1936, P. 44–6; *C. A.*, 1936, V. 30, Col. 7855. (W)

ENZYMES: USE OF—IN THE TEXTILE INDUSTRY. Wm. Bennett. *Indian Textile J.*, 1936, V. 47, P. 22–3; *C. A.*, 1937, V. 31, Col. 544.

Applications of enzymes in finishing and in calico printing are noted. (W)

EXAMINATION OF DYED COTTON. E. Herzog. *Deut. Färber-Ztg.*, 1936, V. 72, P. 183–4; *C. A.*, 1937, V. 31, Col. 260.

A review of phys. and chem. methods. (W)

JUTE: CHEMICAL TREATMENT OF. Lejuteux. *Tiba*, 1936, V. 14, P. 565, 567.

A brief outline of the bleaching and dyeing of jute, of its prepn. and weaving, and of the sizing of the woven fabric. (From *C. A.*, 1936, V. 30, Col. 7857.) (W)

LOADING SILK WITH ZINC. S. Ponsot. *Rusta*, 1936, V. 11, P. 523, 525; *C. A.*, 1936, V. 30, Col. 8627. (W)

MERCERIZATION: IMPROVEMENT OF LUSTER OF COTTON WITHOUT. Theodor Kuhlmann. *Klepzig's Textil-Z.*, 1936, V. 39, P. 693.

Mercerization can be omitted by using the textile aid Tylose 4 SM, which improved the wear resistance and increased the luster. The method involving alkali, acid and appropriate mech. after treatments is particularly adapted for shirt fabrics. After the removal of the acid the feel of the goods is greatly improved by washing with soap and $NaBO_3$. Any slight changes in the indanthrene dyeings by the use of this textile aid are avoided by the soap-$NaBO_3$ after treatment. (From *C. A.*, 1937, V. 31, Col. 546.) (W)

MERCERIZATION OF COTTON AND STAPLE FIBRE MIXTURES. *Tex. Mfr.*, Nov. 1936, P. 441.

Mercerizing of mixtures of cotton and staple fibre give a desirable result, but the standard process is risky. Suggestions are given for adaptation of the usual methods. (C)

STEARIN: INHIBITED DEPOSITION OF—FROM CHILLED OLIVE OIL. W. Clayton, S. Back, R. I. Johnson and J. F. Morse. *J. Soc. Dyers Col.*, Feb. 1937, P. 62.

The addition of very small amounts of air-blown cacao-butter (Iodine No. = 20) to olive oil permits such oil to remain liquid and free from stearin deposit on storage at 2–4° C. (*Nature*, 1936, *138*, 801). Untreated olive oil in such storage sets solid within 12 hr., whereas the inhibition effect persists after even four years' storage at 2° C. The amount of blown cacao-butter required varies from 0.1 to 0.5%, depending on the technique of its oxidation, and the length of time the olive oil is to be stored cool. The inhibition effect is highly specific in that (*a*) no other blown oil or fat serves so well, and (*b*) protection is not afforded to other oils, *e.g.*, arachis or cotton-seed. (C)

STRIPPING: MODERN RESEARCH EVOLVES NEW AGENTS FOR. *Tex. Col.*, Jan. 1937, P. 13–4. (C)

SULFONATED (SULFATED) OILS: DETERMINATION OF ALKALINITIES AND ACIDITIES IN. Report No. 6 of Sub-committee of A. A. T. C. C. on Sulphonated Oils. Ralph Hart, *Chm. Am. Dye. Rptr.*, Dec. 14, 1936, P. 696–707; *Rayon Tex. Mo.*, 1937, Jan., P. 87–8; Feb., P. 70–2. (C)

SYNTHETIC RESINS, THEIR FORMATION, ELASTIC AND PLASTIC PROPERTIES AND POSSIBILITIES. R. Houwink. *J. Soc. Chem. Ind.*, Sept. 4, 1936, P. 247T–59T.

A summary is given of the lines along which resin formation is possible, with particular reference to: (1) the chemical nature of the reactions, with some observations concerning recent studies on reaction kinetics; (2) the colloidal structure of linear and three-dimensional polymerides in their various stages of formation; a comparison is made between thermoplastic and thermosetting resins on the basis of their intermolecular bonds; (3) the plastic and elastic properties of resins according to their state of polymerization; an attempt is made to connect the changes in elastic and plastic deformability on polymerization with changes in colloidal structure of the resins, as may be expected on the basis of current chemical theories about polymerization reaction. (From *Eastman Kodak Abs. Bull.*, Dec. 1936, P. 551–2.) (S)

VAT COLOR PRINTING: NOTES ON PROGRESS OF. *Tex. Col.*, Feb., 1937. P. 83–5. (C)

VAT PRINTING PASTES AND THICKENERS: MEASURABLE PROPERTIES OF. Sivert N. Glarum. *Am. Dye. Rptr.*, Mar. 8, 1937, P. 124–6.

From data briefly presented it is apparent that if the characteristics of these thickeners, as shown by the flow curves, are taken into account it is possible to choose a thickener for any desired work that will give almost any effect or that will emphasize any particular quality. (C)

WATERPROOFING FABRICS. *Tiba*, 1935, V. 30, P. 837; *Am. Dye. Rptr.*, Mar. 8, 1937, P. 140. (C)

WATERPROOFING PILE FABRICS: NOTES ON. T. Ridd. *Am. Dye. Rptr.*, Feb. 22, 1937, P. 85–8. (C)

WOOL DYEING EFFICIENCY. Edward W. Pierce. *Rayon Tex. Mo.*, Jan. 1937, P. 58–9. (C)

(WOOL.) DYEING FAULTS: SOME ANALYTICAL METHODS USED FOR IDENTIFICATION OF. H. R. Hirst. *J. Soc. Dyers Col.*, Feb. 1937, P. 45–50.

Among the subjects specifically covered are the following: Dyeing defects caused by the presence of natural and artificial impurities; detection of metallic impurities and their origin and effects; resist defects; defects in loose wool; detection of oil impurities; scorching and miscellaneous faults. (C)

WOOL DYEING: THEORY OF. F. L. Goodall. *J. Soc. Dyers Col.*, Feb. 1937, P. 50–6; *Tex. Mfr.*, Mar. 1937, P. 117–8.

Progress is being made towards an explanation of the dyeing of wool on the basis of its micellar and chemical structure. Donnan theory plays a part. A classification of acid dyes according to particle size is suggested. (C)

IV. Research Methods and Apparatus

Mechanical–physical and Chemical Methods for Detecting Injury to Wool. O. Viertel. *Mell. Textilber.*, 1936, V. 17, P. 868–72; *J. Soc. Dyers Col.*, Jan. 1937, P. 43. (C)

Microscopic Testing Methods in the Rayon Industry. Dr. A. Carsten. *Kunstseide*, Sept. 1936, P. 329.

The microscope and photomicography, which are indispensable for constant control of production in the rayon industry, have been used for a comparatively short time, but they have been so much improved during the last few years that they now meet nearly all requirements. In the article under discussion it is noted that improved light sources for observation and photography are now frequently low voltage lamps of from 30 to 50 watts, for a fluorescent mercury vapor lamp of special form for the investigation in ultra violet are also employed. Among the methods of illumination which have proved very useful in practical work is that of Prof. Hauser: combined reflected and transmitted illumination which gives a somewhat plastic appearance to the object tested—particularly in the case of fabrics which are somewhat open in their structure. There is also Toetler's so-called "streak" method, which is particularly suited to the examination of transparent objects for such determinations as that of the rate of diffusion, the solubility of salt and the penetration of dyes, etc. The author describes in detail the different testing methods, modern apparatus, construction of the latter which may vary according to the purpose for which it is used, the illumination method, etc. The article is accompanied by illustrations of apparatus and reproductions of photomicrographs taken with the pieces of equipment. (S)

Stereophotomicrography: Methods of. J. R. Baker. *Phot. J.*, May, 1936, P. 275–9.

A special tilting stage is described, by means of which it is possible to make stereoscopic photographs with high, medium, or low powers of the microscope. The object is photographed, rotated through 15 about an axis at right angles to the optical axis of the microscope, and then rephotographed. The photographs are viewed by approximately parallel vision through an ordinary stereoscope. (From Bausch and Lomb Optical Co.) (S)

Stereoscopic Photography. *Ideal Kinema*, April 11, 1935, P. 52.

A process of stereoscopic photography invented by J. Bradshaw is similar to the well-known Ives process. In taking the photograph, the camera is moved on an arc having as its center the subject filmed. At the same time, a grid is moved slowly across the plate, which splits up the image into a large number of vertical strips. It is claimed that, if the print made from this film be viewed through a lenticulated glass screen, a true stereoscopic effect is obtained. (From Bausch and Lomb Optical Co.) (S)

Wetting-out Efficiency: Determination of. J. Hetzer. *Fettchemische Umschau* 1936, V. 43, P. 4.

In view of the fact that it has been observed that reproducible results regarding wetting-out efficiency can be obtained only if the time during

which the test piece sinks below the surface is two seconds or less, the author proposes a "wetting-out Number." He defines as this number (Netzzahl) the critical concentration which under certain experimental standardization produces a wetting-out time in terms of total submersion of a cotton square in two seconds. (X)

WOOL AND MOHAIR: DETERMINATION OF—BY SCALE SIZE AND DIAMETER. John H. Skinkle. *Am. Dye. Rptr.*, Nov. 16, 1936, P. 620–1; *Am. W. & C. Rptr.*, Dec. 24, 1936, P. 11, 18; Lowell (Mass.) Textile Institute *Bulletin*, Nov. 1936.

Tabulated data show that the scale in microns for all mohairs is above 18, and below 18 for all wools. All but two wools were below 17, and all but two mohairs were 18.5 or above. (C)

LABORATORY LAY-OUT SUGGESTED FOR SMALLER GRAY GOODS MILL. Jos. L. Delaney. *Cotton*, Jan. 1937, P. 51–4. (C)

MICROSCOPE GIVES CLUES TO DEFECTS IN RAYON FABRICS. Julius B. Goldberg. *Tex. Wld.*, Jan. 1937, P. 101–3.

An excellent series of photomicrographs is accompanied by explanation of their use in revealing defects. (C)

MEASURING RESISTANCE TO WEAR AND TEAR. O. Mecheels. *Mell. Textilber.*, 1936, P. 239; *Rayon Tex. Mo.*, Aug. 1936, P. 84.

The measurements of strength and elongation most usually carried out do not permit of any conclusion as to the wearing qualities of garments. It has now been found that reliable conclusions can be drawn as to the way in which textiles will stand wear and tear by testing them not only by abrasion, but also by impact in a regular manner. Resistance to wear and tear is measured by the following three factors: impact, abrasion, and recovery. The author deals with each of these in the present article, which is accompanied by illustrations and tables. (C)

MEASURING THE LUSTER OF RAYON YARNS. A. Stuart Hunter. *Rayon Tex. Mo.*, 1936, Sept., P. 111–2; Oct., P. 53–4.

Summarizes the principles involved and describes construction and use of Du Pont Luster Meter. (C)

PHOTO-ELECTRIC FASTNESS TEST ILLUMINATION RECORDER: APPLICATION. H. Ris. *Mell. Textilber.*, 1936, V. 17, P. 498–500; *J. T. I.*, Aug. 1936, P. A396; *J. Soc. Dyers Col.*, Aug. 1936, P. 323.

The response of various types of photo-electric cells is discussed with reference to their application in measuring the actual quantities of light to which dyeings are exposed in fading tests. It is suggested that electrically standardized exposures should be used to compare the results obtained in fading tests carried out in different seasons and in different places. (C)

RAYON TESTING: PROGRESS IN. Staff of U. S. Testing Co. *Rayon Tex. Mo.*, Sept. 1936, P. 94–6. (C)

SPUN RAYON: DETERMINATION OF—IN MIXED YARNS AND MIXED FABRICS. O. Viertel. *Monatschr. Textil-Ind.*, V. 51, Fachheft, II, July 1936, P. 41–4.

A review of methods of sepg. spun rayon from cotton, wool and natural silk. Various quant. detns. of spun rayon are described with full details. (From *C. A.*, 1936, V. 30, Col. 7860.) (W)

TEXTILE MICROSCOPY: RECENT TRENDS IN. John H. Skinkle. *Am. Dye. Rptr.*, Nov. 30, 1936, P. 649–50. (C)

WATER: NOVEL PROOFING TESTER FOR DETERMINING THE EXTENT TO WHICH TEXTILES ABSORB OR ARE PERMEABLE BY. H. Franz and H. J. Henning. *Mell. Textilber.*, 1936, No. 12, P. 926.

The basic idea of the method is to spray the material, which has been stretched over a drum or cylinder, and to determine the quantity of water that has been absorbed and that has percolated through, respectively. While the cloth is being sprayed, it is kept in motion by rotating the cylinder and exerting friction upon the back; thereafter it is hydro-extracted. The results of the tests which are given in the article show the usefulness of the apparatus and yield information about factors which affect the accuracy of measurements. (C)

WOOL AND SILK FABRICS: LABORATORY REPORT ON TESTS TO DETERMINE CAUSES OF STRETCH AND SLIPPAGE OF YARNS IN CERTAIN. Katherine Cranor, Eleanor McFadden and Lutie Fryer. *Iowa State College J. Sci.*, 1936, V, X, No. 3, P. 317–39. (C)

V. ECONOMICS, PHYSICS AND MISCELLANY

GELATIN: FRACTIONATION AND OPTICAL ROTATION. S. M. Liepatoff and I. N. Putilowa. *Kolloid Z.*, 1936, V. 76, P. 176–8.

Gelatin has been separated into a series of fractions which differ only in solubility and in micelle weight. Theories which explain the difference of these fractions are discussed, and, further to investigate the subject, the optical activity of four gelatin fractions was measured, the effect of time and temperature being investigated. The results are tabulated. All four fractions have different values of specific rotation. The existence of two isomeric forms of gelatin is unlikely, however, and the difference in the optical properties is explained by a different type of structure of the micelles themselves. (From *J. T. I.*, Nov. 1936, P. A571.) (C)

MECHANICS OF SOLID BODIES. Part I. T. Pöschl. *Die Physik*, 1936, V. 4, No. 4, P. 131–44.

A summary of literature on the mechanical properties and behavior of solids. (From *Sci. Abs.*, Dec. 25, 1936, No. 468.) (X)

OPTICAL INVESTIGATION OF INDIAN OILS. I. DEPOLARIZATION OF SCATTERED LIGHT. C. V. Jogarao. *Indian Acad. Sci. Proc.*, Sept. 1936, P. 327–31.

The degree of polarization of the light scattered transversely from a number of purified vegetable oils, illuminated by plane polarized or by unpolarized light, is examined. Complete depolarization is found in the

transversely scattered light; hence, following Krishnan, the oils contain no large molecular aggregates. Contrary to Krishnan's findings, pure formic and acetic acids also show complete depolarization. (From *Sci. Abs.*, Dec. 25, 1936, No. 5530.) (X)

POLARIZATION OF LIGHT AND SOME TECHNICAL APPLICATIONS. A. F. C. Pollard. *Nature*, Aug. 22, 1936, P. 311–4.

An account is given of Land's invention of Polaroid, a polarizing material in sheet form. The method of manufacture and some of the principal properties of the material are described. The work of Weigert and others on the transformation of certain isotropic colloidal systems into systems with double refracting and dichroic properties following exposure to plane polarized light is briefly outlined. (From *Sci. Abs.*, Nov. 1936, No. 5115.) (X)

POLAROID LIGHT-POLARIZING MATERIAL. *Engineering*, Aug. 28, 1936, P. 235–6.

Deals briefly with the manufacture and uses of a new polarizing material, known as "Polaroid," which consists of a cellulose film usually mounted between two glass plates, the whole area of the film acting as a single crystal. The uses referred to are the detection and analysis of strains in transparent materials, photographic uses, and the elimination of glare from motor-car headlights. (From *Sci. Abs.*, Oct. 25, 1936, No. 4673.) (X)

SLOW VISCOUS FLOW AND ELASTIC DEFORMATION. J. N. Goodier. *Phil. Mag.*, Oct. 1936, P. 678–81.

The recent papers of Gemant and Yates-Fish and the "First Report on Viscosity and Plasticity" of the Committee of the Amsterdam Academy of Sciences (1935), suggest that full advantage is not being taken of the analogy between slow steady viscous motion and elastic deformation. The author points out that this analogy enables the taking over from the theory of viscous flow of solutions of the elastic problems arising in the dipole theory, and the taking over from elasticity of formulae and observations of which the theory of viscosity measurements stands in need. Full appreciation of it would also prevent further duplication of analysis in the solution of analogous problems in the two theories. (From *Sci. Abs.*, Nov. 1936, No. 5026.) (X)

Book Review

JUTE AND SUBSTITUTES. N. C. Chaudhury. 250 pp., illustrations. Price $6.00. Copies can be obtained from Textile Colorist, Inc., 233 Broadway, New York, N. Y.

This new publication upon jute contains complete information regarding this fibre, including the chemistry and races of jute, its cultivation, research work which has been applied to it, the commercial aspect, description of the industry, many tables of statistics and miscellaneous information regarding substitutes for jute, and many of its individual and specific applications. This book is of value not only to those who specialize in jute but also to everyone interested in the textile industry, and hence it should find place in the library of every textile chemist and manufacturer of textile fabrics. (From *Tex. Col.*, Feb. 1937, P. 131.) (C)